Magnetic moment of the 2^+ state in the neutron-rich radioactive ^{72}Zn using the High-Velocity Transient-Field technique

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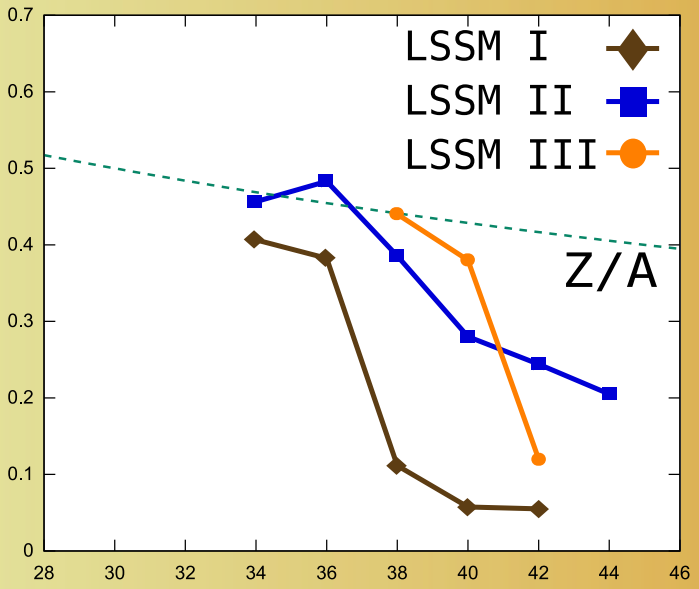
Overview

Nuclear Moments
informations on nuclear structure

Magnetic Dipole
wave function composition

N=40 region
deformation



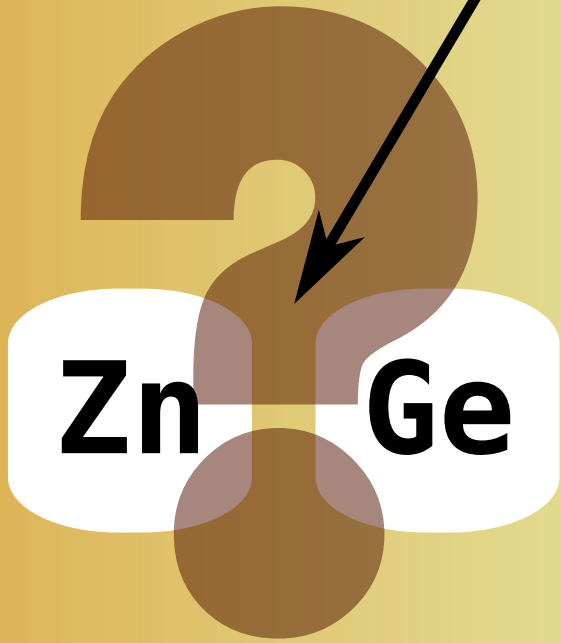
High Velocity Transient Field
new information for heavy-ions

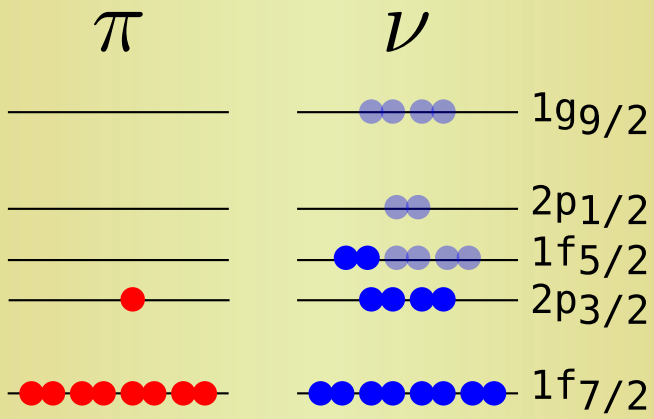
$$B_{TF} = p_{1s}(Z, host) \cdot q_{1s}(v, Z, host) \cdot B_{1s}(Z)$$

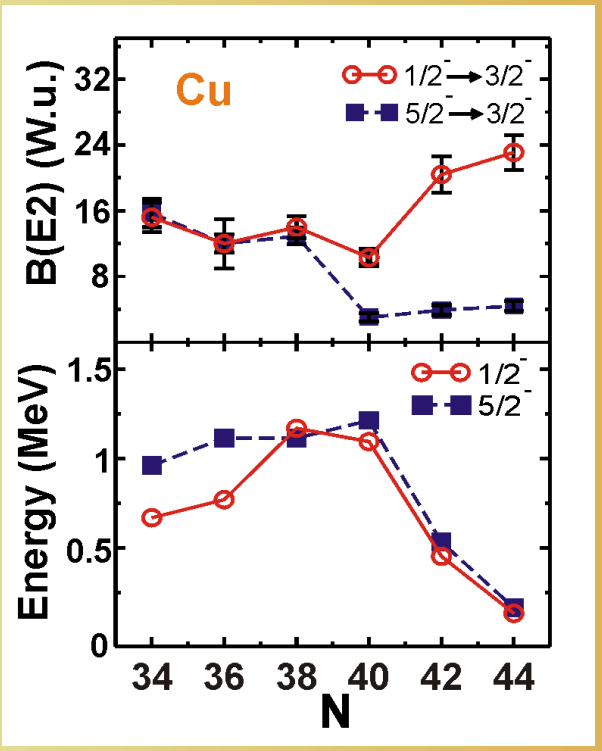
Inside the N=40 region

Coexistance of **single-particle-like** and **collective** states at very low excitation energies

Significant change in the structure of the odd-A Cu isotopes beyond N=40 (**monopole migration**)







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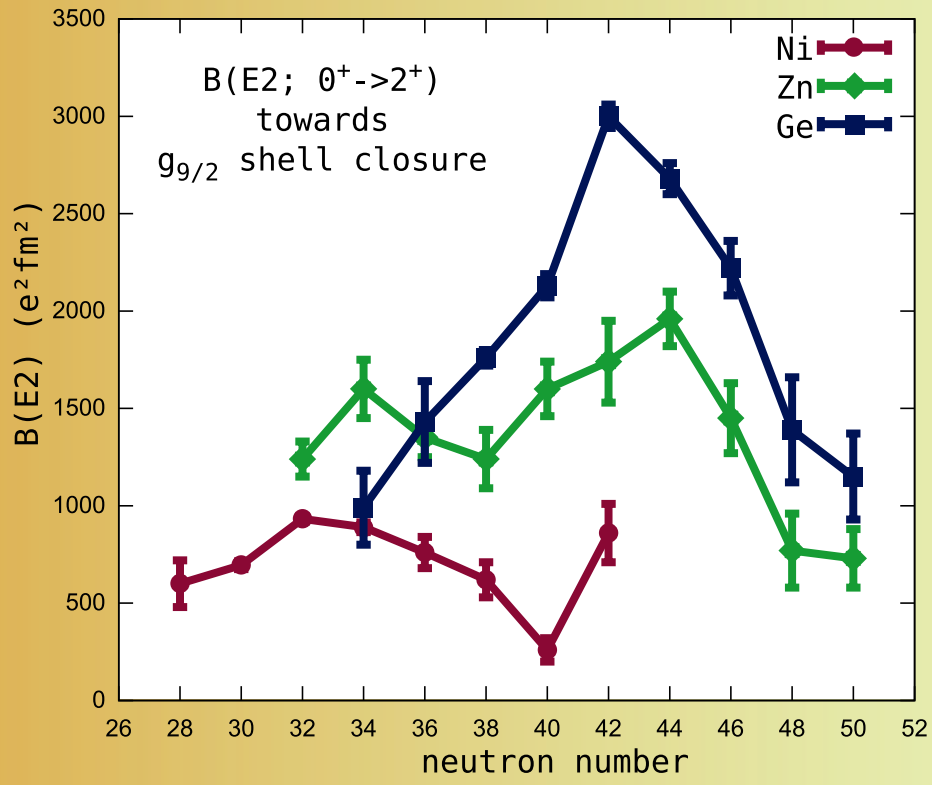
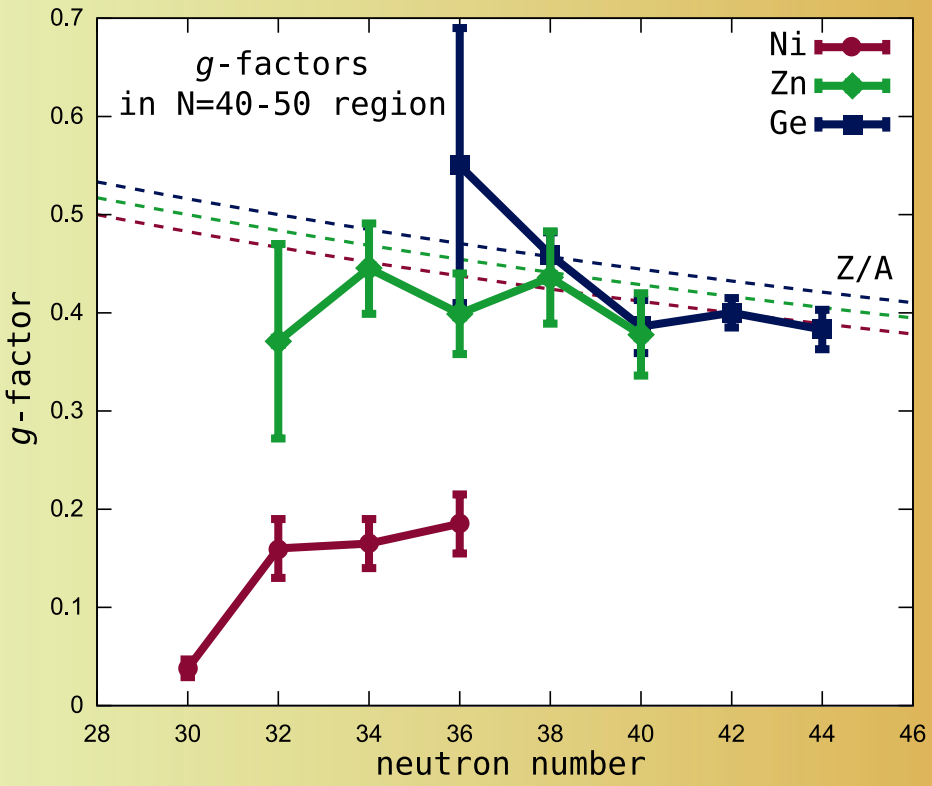
Neutron $g_{9/2}$ from N=40 to N=50





Transition region:

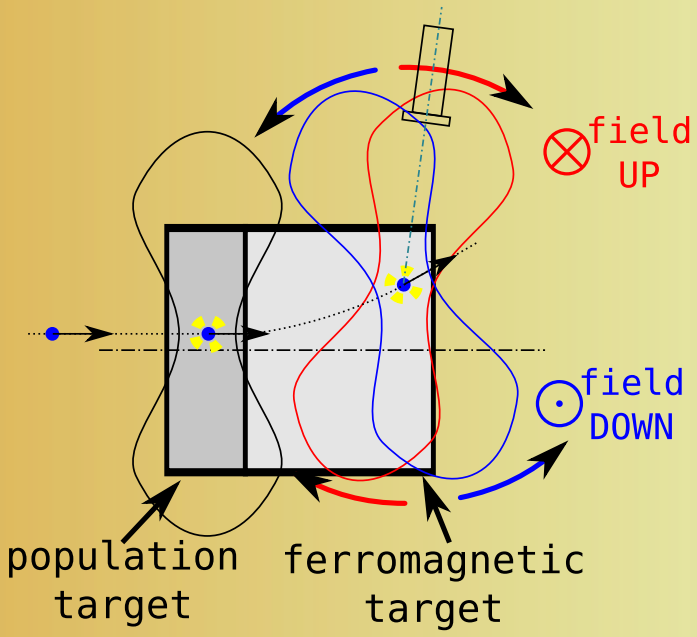
Ni → Zn → Ge

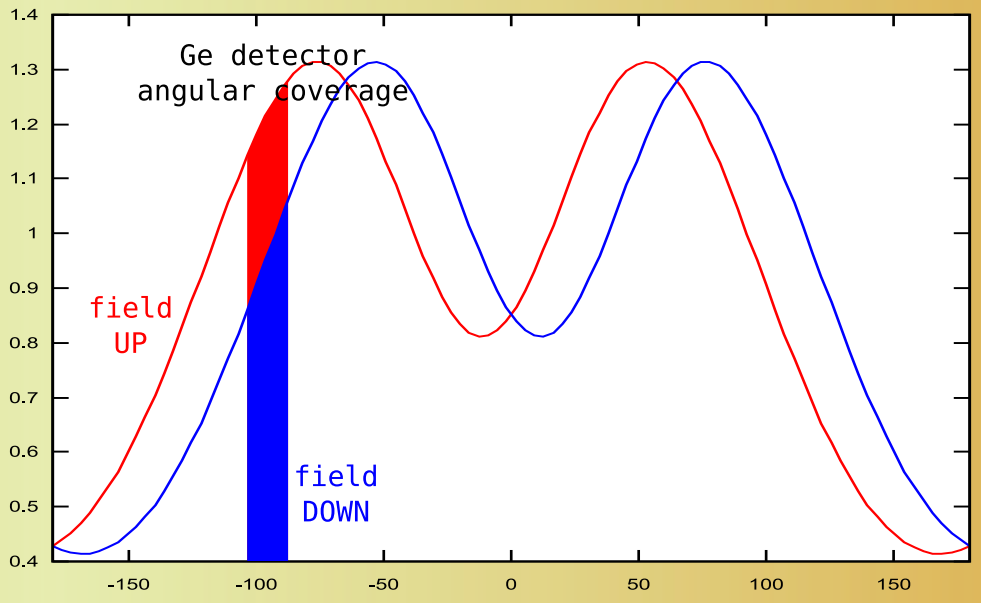
Single particle ? Collective

IPAC
Integral Perturbed Angular Correlation

$$\Delta\theta = -g\frac{\mu_N}{\hbar}B_{ext}\Delta t$$

measures the precession angle $\Delta\theta$ due to a magnetic field B_{ext} interacting for an interval Δt





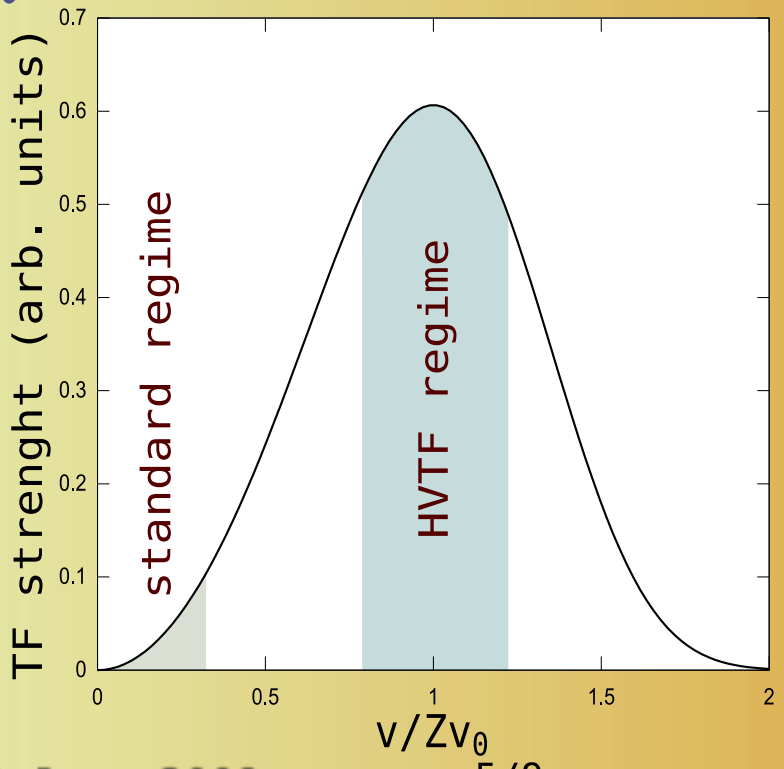
Transient Field technique

$$\Delta\theta = -g\frac{\mu_N}{\hbar}B_{ext}\Delta t$$

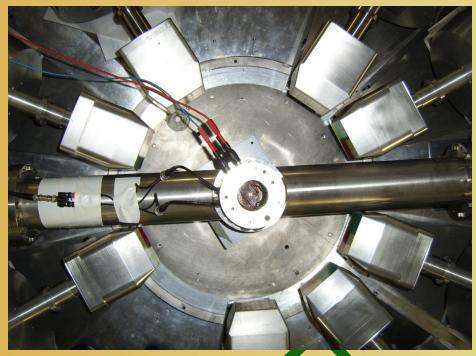
if $\Delta t \approx 1ps$ we need $B_{ext} \approx 1kT$ to have $\Delta\theta \approx 10mrad$

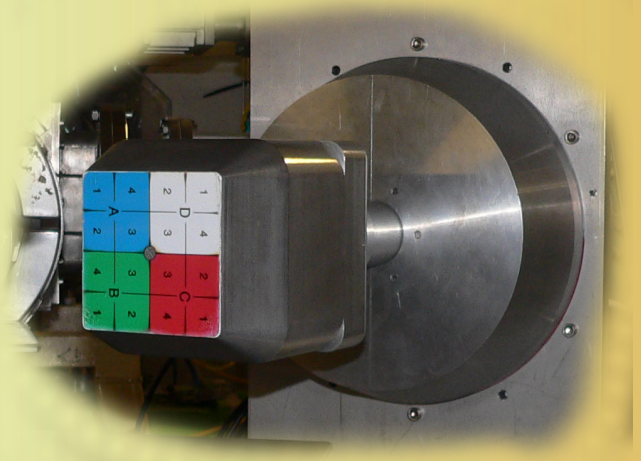
Transient Field

hyperfine magnetic field that
an ion is experiencing traversing
a polarized ferromagnetic layer



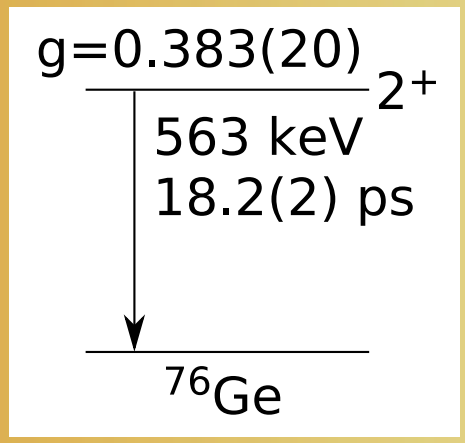
Experimental Setup





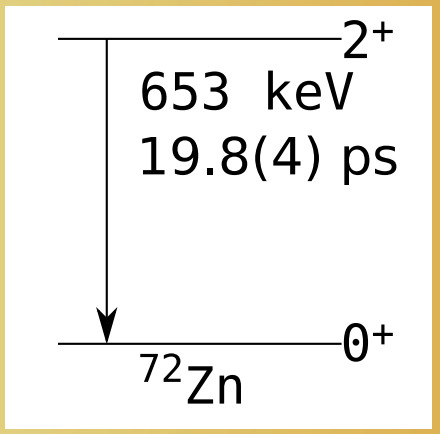
The green detectors couples are used to measure the precession effect
The two detectors in blue are used for a better determination of the angular distribution

^{72}Zn and ^{76}Ge



$$\Delta\theta = -g\frac{\mu_N}{\hbar}B_{TF}\Delta t$$

$$g_{Zn} = \frac{B_{TF}(Zn)\Delta\theta_{Zn}}{B_{TF}(Ge)\Delta\theta_{Ge}}g_{Ge}$$



^{76}Ge beam
well known g-factor

B_{TF} calibration

^{72}Zn g-factor
unknown

- 45 MeV/u ^{72}Zn from fragmentation of 60 MeV/u ^{76}Ge on 0.5 mm ^{9}Be
- populated via Coulomb exitation in Gd target 204 mg/cm^2
- interaction time: ~2 ps

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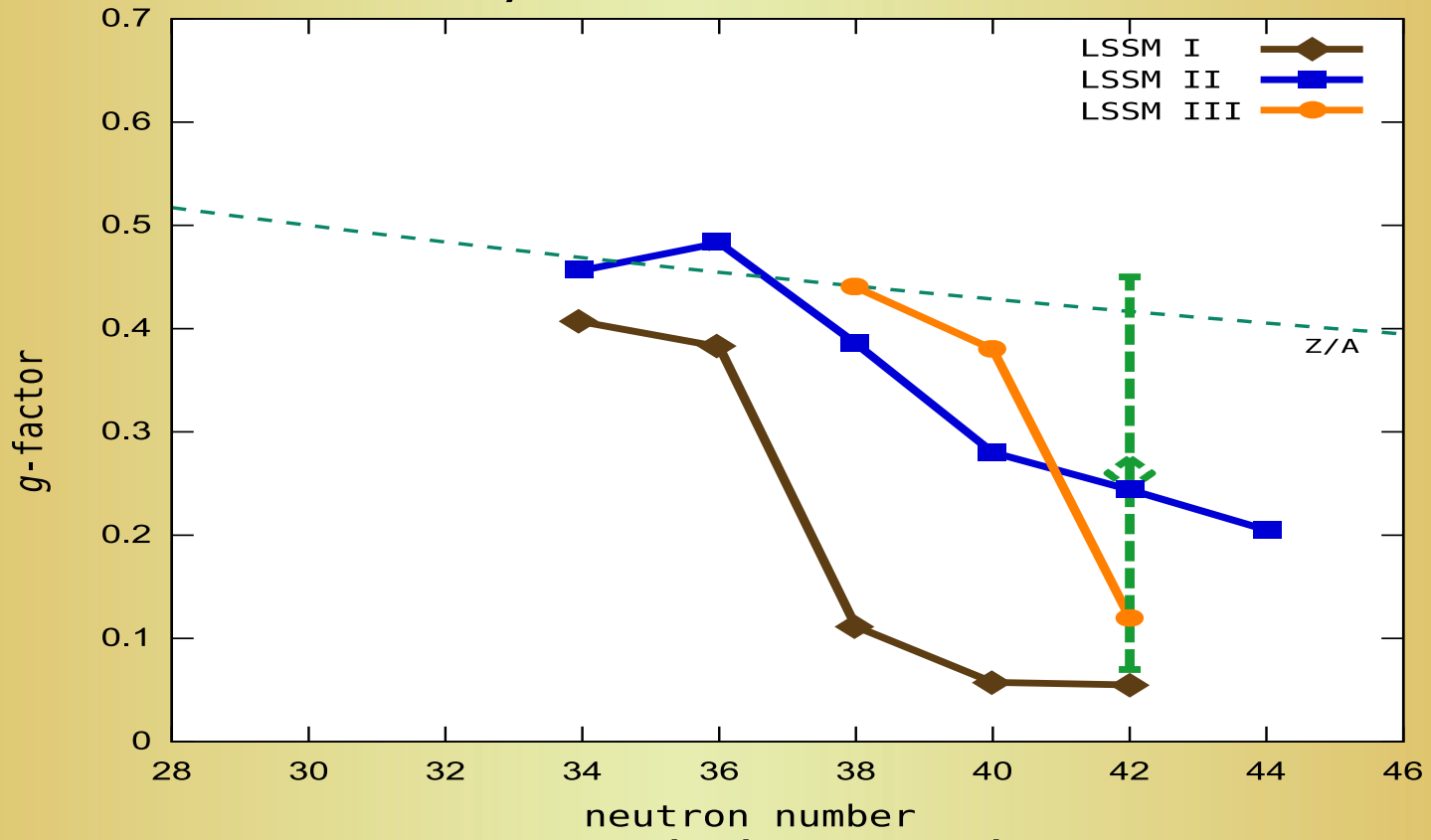

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Single particle ? Collective

Conclusions

Deviation of the g-factor from the Z/A limit

Applicability of the HVTF technique to heavy ions

Advantage of Gadolinium over Iron